

### REMARKS

Claims 1-7 are pending. No new matter is added. Reconsideration and allowance of the above-referenced application are respectfully requested.

#### Priority

The present application claims priority to US Application Serial No. 10/683,269, filed on October 14, 2003. The priority information was included in a Declaration and Power of Attorney that was filed with the present application. However, the priority claim was not included in the Specification of the present application.

Pursuant to this response, the Specification is amended to include a priority claim as follows:

#### **CROSS-REFERENCE TO RELATED APPLICATION**

[0000.1] This application claims the benefit of priority to U.S. Patent Application Serial No. 10/683,269 entitled "Pin Assembly for Track Roller Bogie of Track-Type Drive System" filed on October 14, 2003, and now abandoned.

Further, in accordance with 37 CFR 1.78(a)(3), a Petition to Accept a Delayed Priority Claim was filed with the response of July 7 2008. However, the petition was dismissed because the amendment to the Specification to include the priority claim incorporated an application by reference. A second Petition to Accept a Delayed Priority Claim was filed with the supplemental amendment filed on August 15 2008. The second petition was also dismissed because the incorrect application number was included in the priority claim. A new Petition to Accept a Delayed Priority Claim is filed with this supplemental amendment. As set forth in 37 CFR 1.78(a)(3), the new petition is accompanied by the reference required under 35 USC 120 and 37 CFR 1.78(a)(2) to the prior-filed application, the surcharge set forth in 37 CFR 1.17(t), and a statement that the entire delay between the date the claim was due under 37 CFR 1.78(a)(2)(ii) and the date the claim was filed was unintentional. A Declaration from Applicants' representative, Mutsumi International Patent Bureau, explaining the circumstances that caused the delay is also attached to this response.

### Drawings

Applicants acknowledge the receipt of a Final Office Action mailed on December 17, 2008 in this application. The Final Office Action includes objections to the drawings. These objections will be addressed in due course.

### 35 USC 102

Claims 1-7 stand rejected under 35 USC 102(e) as allegedly being anticipated by Murakami et al. hereinafter "Murakami." Applicants respectfully submitted that a grant of the Petition to Accept a Delayed Priority Claim that is filed with this response will obviate these rejections.

As discussed previously, the present application claims priority to Murakami. Although the priority information was included in a Declaration executed by the inventors, the priority claim was inadvertently omitted from the Specification. In this response, an amendment to include the priority claim is presented along with a Petition to accept an unintentionally delayed priority claim.

Applicants respectfully request that the Petition be granted. Further, Applicants submit that upon the petition being granted, the present application will properly claim priority to Murakami. Consequently, Murakami is not prior art under any section of 35 USC 102.

Accordingly, Applicants respectfully submit that claims 1-7 are not anticipated by Murakami, and request that the rejections of claims 1-7 under 35 USC 102(e) be withdrawn.

### CONCLUSION

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the remarks made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this

Applicant : Shota Murakami et al.  
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paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance, and such action is respectfully requested at the Examiner's earliest convenience.

Please apply any charges or credits to deposit account 06-1050.

Respectfully submitted,

Date: December 19 2008

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(54) **PIN ASSEMBLY FOR TRACK ROLLER  
BOGIE OF TRACK-TYPE DRIVE SYSTEM**

**Publication Classification**

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(51) **Int. Cl.<sup>7</sup> ..... B62D 55/00**

(52) **U.S. Cl. .... 180/9.1**

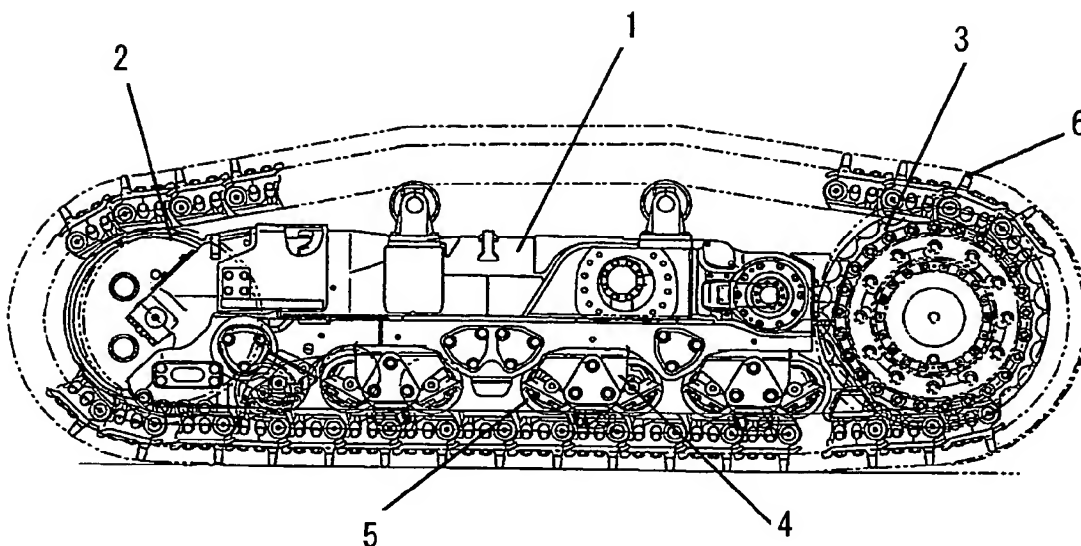
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(57) **ABSTRACT**

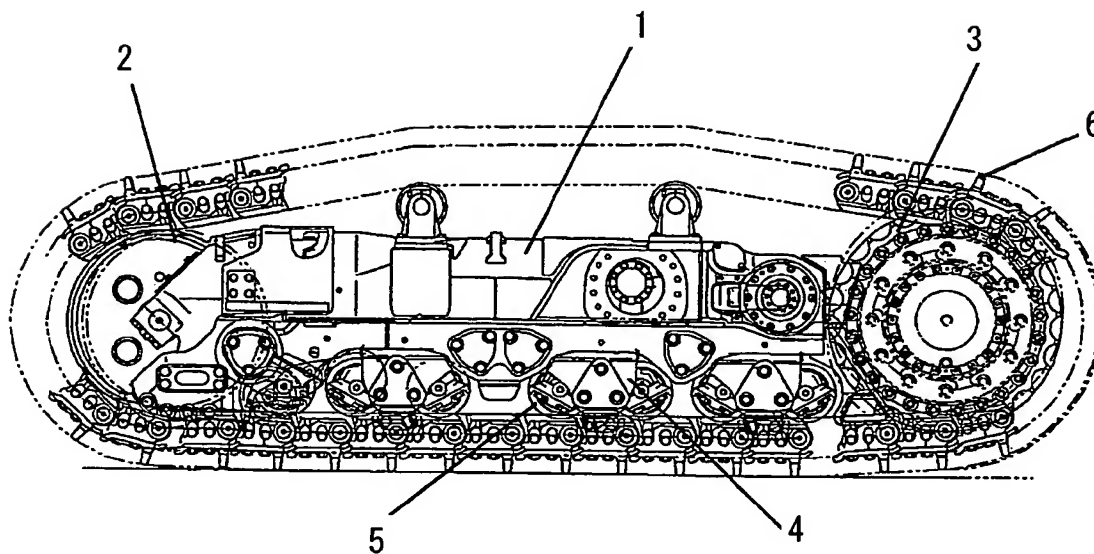
A track roller bogie is pivotally supported by a pin assembly, in which a spacer for receiving a thrust load is abolished and the thrust load is supported by outer rings of the pin assembly themselves. It makes possible to assemble a pin assembly easier and to elongate a service life of the track bogie.

(21) Appl. No.: **10/683,269**

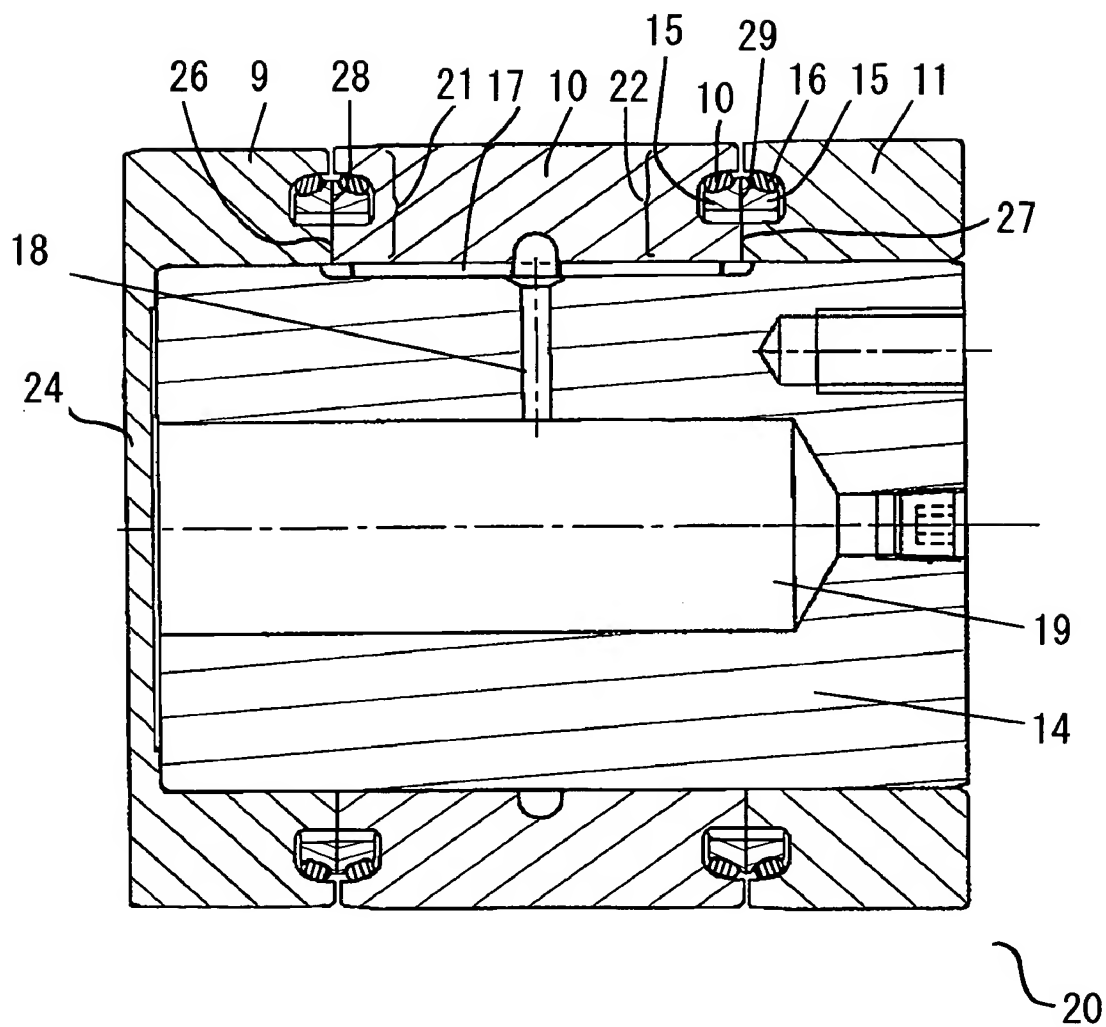
(22) Filed: **Oct. 14, 2003**



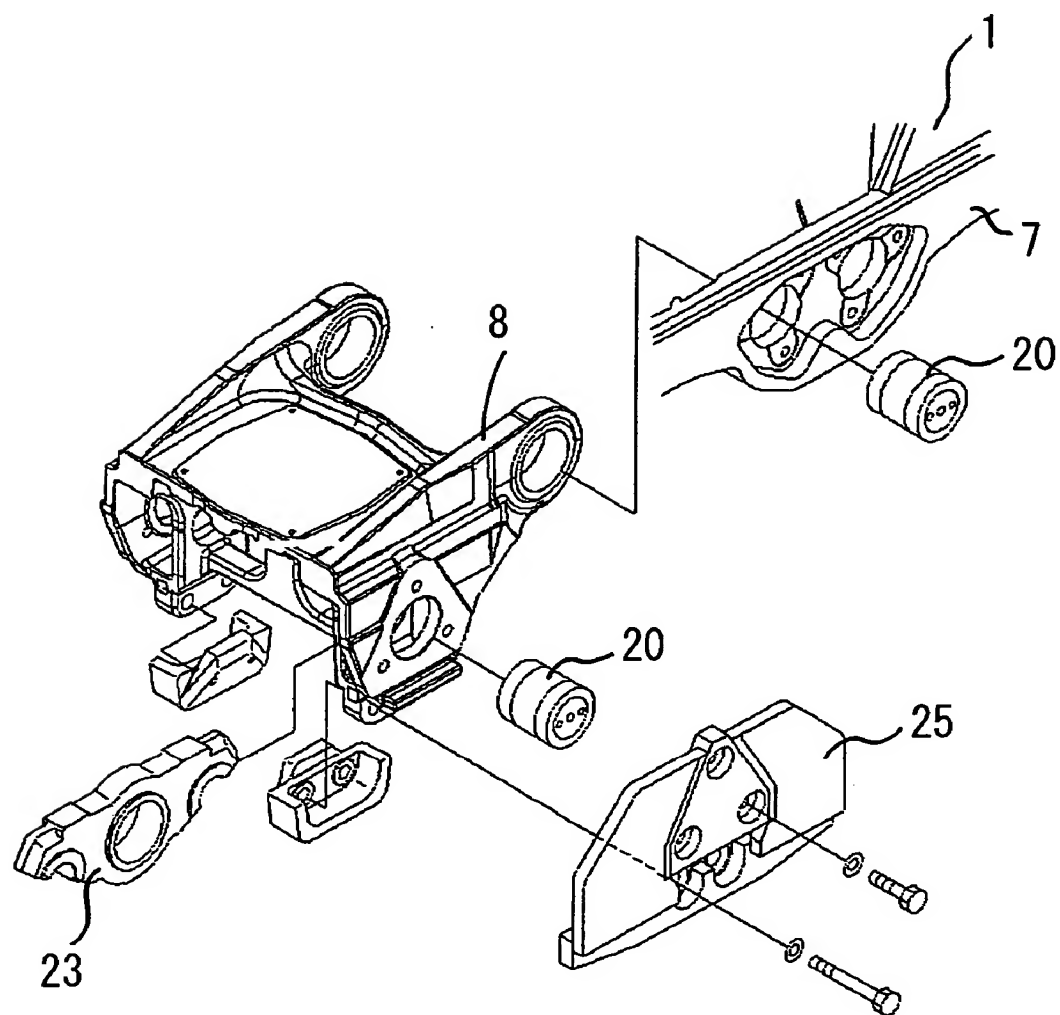
**Fig.1**



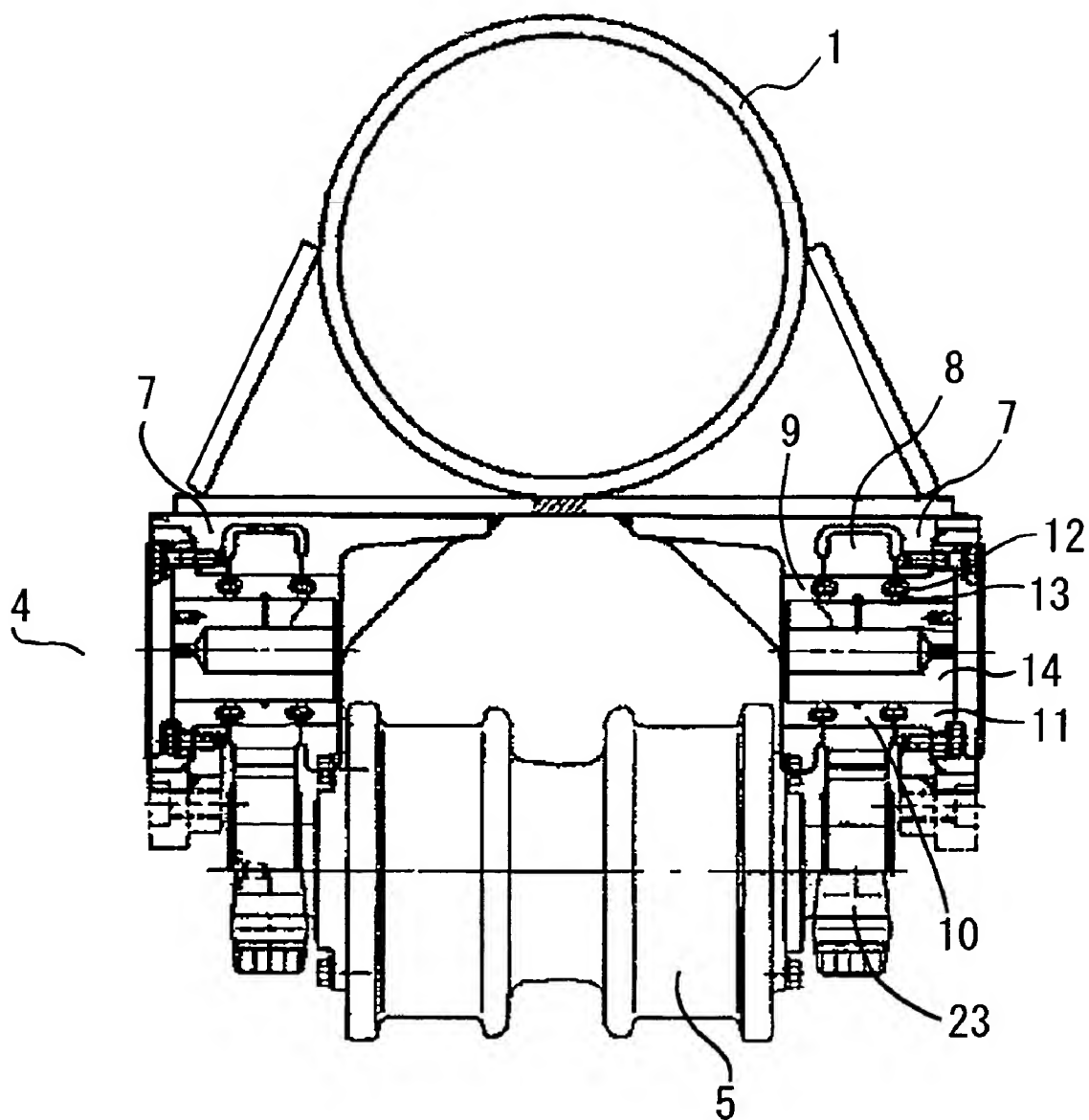
**Fig.2**



**Fig.3**

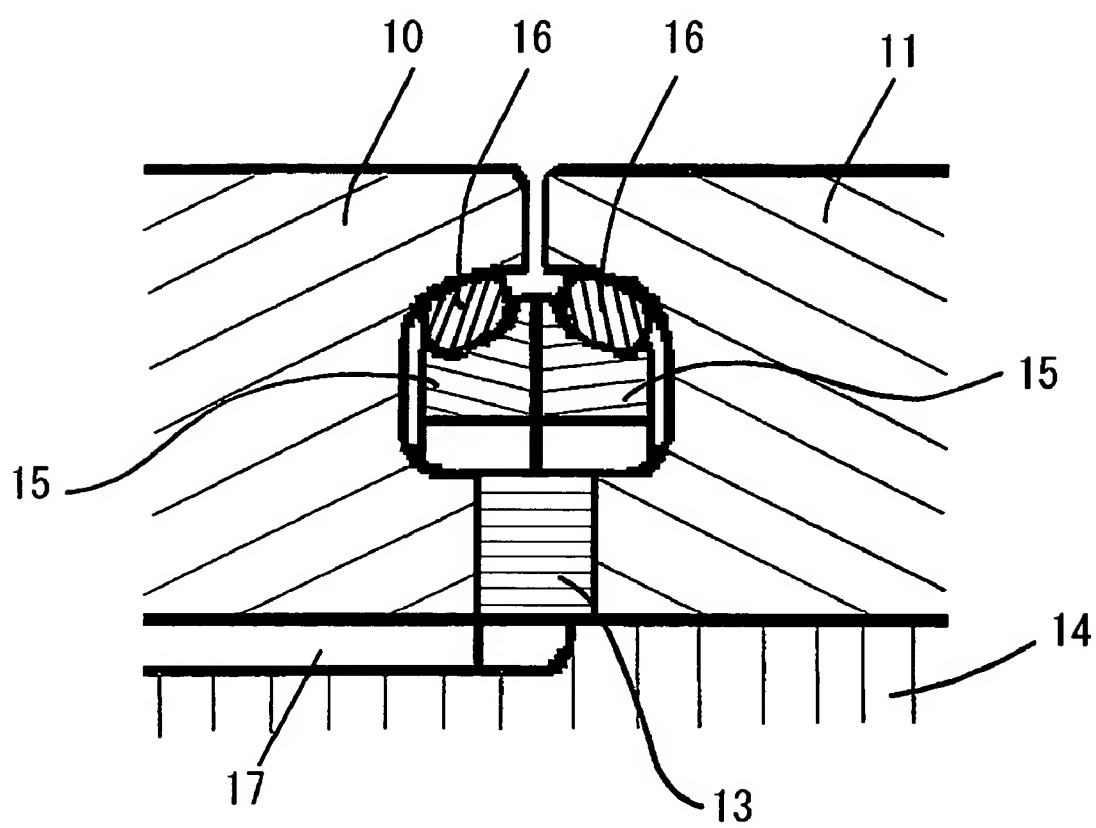


**Fig.4**  
**Prior Art**





**Fig.5**  
**Prior Art**



## PIN ASSEMBLY FOR TRACK ROLLER BOGIE OF TRACK-TYPE DRIVE SYSTEM

### BACKGROUND OF THE INVENTION

#### [0001] 1. Field of the Invention

[0002] The present invention relates to a pin assembly, and more particularly to a pin assembly for pivoting a track roller bogie (hereinafter, refer simply to a bogie) of a track-type drive system.

#### [0003] 2. Description of the Prior Art

[0004] The track-type drive system corresponds to a system driving a vehicle by driving a track connecting links having track shoes in an annular shape by pins by means of a sprocket. The drive system mentioned above has a larger ground contact area in comparison with a drive system employing wheels, and is mainly used in a vehicle driving on a rough ground, a snow ground, a weak ground, a battlefield, a civil work field and the like.

[0005] A typical track-type drive system is shown in FIG. 1. An idler 2 is pivoted to one end of a track frame 1 swingably attached to a vehicle body, and a sprocket 3 is pivoted to the vehicle body in a direction of another end. A bogie 4 provided with a track roller 5 is mounted to a lower side of the track frame 1. In general, the track roller or the bogie provided with the track roller is mounted to the track frame in accordance with one type that a position of the track roller is fixed, or another type that the track roller is mounted so as to vertically swing. FIG. 1 shows a bogie of the latter type that the track roller is mounted so as to freely swing. A crawler belt 6 is wound around a periphery of the idler 2, the track roller 5 and the sprocket 3. In accordance with this type, since the track roller 5 can follow to a vertical motion of the crawler belt 6, it is possible to more stably ground the vehicle.

[0006] FIG. 4 shows a structure cited from U.S. Pat. No. 6,607,256, and shows details in the periphery of the pivotally supported portion of the bogie 4 to the track frame 1 in the swing-type bogie as shown in FIG. 1. The bogie 4 in these drawings is constituted by a first bogie link 8 and a second bogie link 23. First, another end of the first bogie link 8 is bifurcated, and the bifurcated portions are respectively pivoted to the track frame 1 by pins 14. A second bogie link 23 is rotatably mounted to one end of the first bogie link 8, and the track roller 5 is mounted to an end portion of the second bogie link so as to freely roll.

[0007] Viewing the pivotally supported portion of the first bogie link 8 to the track frame 1 in detail, a pair of left and right brackets 7 and 7 are arranged on an underside of the track frame 1, and an opening portion is provided in each of the brackets. A first ring 9 and a third ring 11 are fixed respectively to inner peripheries of the opening portions in a pair of left and right brackets. The pins 14 are fixed to inner peripheral portions of the first ring 9 and the third ring 11. A second ring 10 is annularly provided between the first ring 9 and the third ring 11 in such a manner as to freely rotate with respect to the pin 14. Another end of the first bogie link is bifurcated in correspondence to a pair of left and right brackets 7 and 7, and an outer periphery of the second ring 10 is fixed to an opening portion existing in the branch portion.

[0008] In this case, it is necessary to lubricate a rotating portion between the second ring 10 and the pin 14, and a slide contact portion among the first, second and third rings by using a lubricant, however, is sealed from an outer portion for the purpose of preventing the lubricant from leaking to the external portion and the purpose of insuring the rotating portion and the slide contact portion against soil grains such as sands, silts and the like. FIG. 5 is an enlarged view around the rotating portion and the slide surface between the second ring 10 and the third ring 11. For the purpose of the sealing mentioned above, annular recess portions are provided in positions opposing to contact surfaces of the respective rings, and a pair of left and right face seals 15 and 15 are inserted thereto. The face seals 15 and 15 are pressure contacted by O-rings 16 and 16 so as to prevent a lubricating oil supplied via a lubricant passage 17 from flowing out to an outer portion of the pivotally supported portion together with the O-rings 16 and 16, and prevent the soil grains from making an intrusion into the rotating portion and the sliding surface from the outer portion.

[0009] Further, spacers 13 formed as a ring having a rectangular cross sectional shape are slidably arranged in inner sides of the face seals 15 and 15 in a radial direction so as to be slidable with respect to each of the second ring 10, the third ring 11 and the pin 14 in a contact state therewith. The spacer 13 is provided for the purpose of transmitting a load in a thrust direction generated in the case that a drive surface is unevenly brought into contact with the track shoe with keeping a level difference in a lateral direction (a lateral direction in FIG. 4) of the track shoe, between the first ring 9 and the second ring 10.

[0010] The sealing and lubricating functions required in the contact portion among the first, second and third rings are achieved by the structure of the pivotally supported portion mentioned above, however, since the contact portion requires totally ten parts comprising a pair of face seals, a pair of O-rings and the spacers, it is troublesome to assemble them. Further, in the spacer, it is necessary to lubricate all the outer peripheral surface thereof, however, since the cross sectional shape is rectangular, the lubricating oil is hard to smoothly circulate around the outer surface, so that there is a problem that a service life of the parts is shortened due to seizure or the like. In other words, since a labyrinth is formed in the portion to be lubricated, there is a problem that a lack of lubrication may be generated. Further, in order to solve the problem, there can be considered a method of improving a lubricating property by making the spacer by a porous material such as a porous cast iron or the like, however, in this case, there is a problem that a manufacturing cost is increased.

### SUMMARY OF THE INVENTION

[0011] The present invention is made by taking the circumstances mentioned above into consideration, and an object of the present invention is to provide a pin assembly which can more easily assemble a pivotally supported portion and solves the problem of the lack of lubrication caused by the rectangular spacer, and a track-type drive system which employs the pin assembly.

[0012] In order to achieve the object mentioned above, in accordance with the present invention, there is provided a pin assembly for a bogie of a track-type drive system, comprising:

[0013] a pin having a lubricant charging hole and a lubricant delivering hole delivering the lubricant from the lubricant charging hole to an outer peripheral portion in an inner portion thereof;

[0014] a first ring having a contact surface with the pin in one end so as to be firmly attached to the pin and having an outer diameter  $D_1$ ;

[0015] a second ring brought into contact with another end side of the first ring in an axial direction of the pin so as to be rotatably pivoted to the pin and having an outer diameter  $D_2$ ; and

[0016] a third ring brought into contact with another end side of the second ring in an axial direction of the pin so as to be firmly attached to the pin and having an outer diameter  $D_3$ ;

[0017] wherein a part of a ring end surface contacted among the first, second and third rings has an annular recess portion, and the annular recess portion consists of a sealing means between rings for sealing therebetween, and the outer diameters  $D_1$ ,  $D_2$  and  $D_3$  have a relation  $D_1 < D_2 < D_3$ .

[0018] Further, in accordance with the present invention, there is provided a pin assembly, wherein the slide portion among the first ring, the second ring and the third ring is constituted by a slide contact surface with which each of the rings is directly contacted, and a seal surface of the sealing means in correspondence to each of the slide contact surfaces, and the slide contact surface and the seal surface form a substantially one flat plane in a radial direction.

[0019] In accordance with another invention, there is provided a track-type drive system comprising:

[0020] a bogie having a track frame, an idler, a sprocket, a carrier roller and a track roller and pivoted to the track frame; and

[0021] a crawler belt wound around them,

[0022] wherein the bogie is pivoted to the track frame by the above pin assembly.

[0023] In accordance with the other invention, there is provided a track-type drive system comprising:

[0024] a bogie having a track frame, an idler, a sprocket, a carrier roller and a track roller and pivoted to the track frame; and

[0025] a crawler belt wound around them,

[0026] wherein the bogie is constituted by a first bogie link pivoted to the track frame, and a second bogie link pivoted to the first bogie link and to which the track roller is mounted, and

[0027] wherein the second bogie link is pivoted to the first bogie link by the above pin assembly.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0028] FIG. 1 is a view showing a general track-type drive system;

[0029] FIG. 2 is a cross sectional view of a pin assembly in accordance with the present invention;

[0030] FIG. 3 is a schematic view of an assembly of a pivotally supported portion of the bogie in accordance with the present invention;

[0031] FIG. 4 is a cross sectional view of a conventional bogie; and

[0032] FIG. 5 is an enlarged view of a part of a conventional pivotally supported portion of the bogie.

#### DETAILED DESCRIPTION OF THE INVENTION

[0033] A description will be given of a particular embodiment of a pin assembly in accordance with the present invention, and a pivoting structure using the same.

[0034] FIG. 2 shows a cross sectional view of a pin assembly in accordance with the present invention, and FIG. 3 shows a schematic view of an assembly of a pivotally supported portion of the bogie of a track-type drive system achieved by the pin assembly.

[0035] A pin 14 is made of a carbon steel, and has a concentric cylindrical hole open in a left side of the pin 14 in FIG. 2. A right side of the hole is formed as an opening having a small diameter, and is closed by a detachable lid. A left side of the pin 14 is pressure inserted to a first ring 9 closing one end (a left side) of the opening so as to form a contact surface 24 with the pin 14, and strikes a right side of the contact surface 24. The cylindrical hole within the pin 14 strikes the contact surface 24, thereby forming the lubricant charging portion 19, and a lubricant such as a lubricating oil, a grease or the like is charged from a small-diameter opening arranged in a right side of the pin 14.

[0036] A second ring 10 is rotatably pivoted to the pin 14 in adjacent to a right side of the first ring 9. Since the first ring 9 is fixed to the pin 14, a slide portion 21 is formed between both the elements in accordance with a rotation of the second ring 10. The slide portion 21 is constituted by three parts. First, a slide contact portion 26 in which the first ring 9 is directly brought into contact with the second ring 10 is provided in a portion closest to an inner diameter side of the slide portion 21 in a radial direction. The slide contact portion 26 forms one flat surface in a radial direction. Since the first ring 9 and the second ring 10 are manufactured by the same material (for example, a chrome molybdenum steel), a surface hardening treatment such as a carburizing and quenching or the like is applied to a portion forming the slide contact surface 26 for the purpose of preventing a seizure. Further, the lubricant is supplied from the lubricant charging portion 19 mentioned above via the lubricant delivering hole 18 and the lubricant passage 17.

[0037] A sealing means having a sealing surface 28 for sealing the lubricant is provided in an outer diameter side of the slide contact surface 26. The sealing means is constituted by a pair of right and left face seals 15 and 15 and O-rings 16 and 16. These are clamped by annular recess portions provided in portions corresponding to the first ring and the second ring, and the face seals 15 and 15 are opposed to each other so as to form a contact surface corresponding to the sealing surface 28. The sealing surface 28 is placed on substantially the same plane as the slide contact surface 26.

[0038] An outer peripheral surface in which the first ring 9 and the second ring 10 are opposed to each other by an

interval about 1 mm is formed in an outermost side of the slide portion 21. A pressing force of the O-ring is set small such that a force is transmitted mainly by the slide contact surface 26 in the case that a load is applied in a thrust direction in the slide portion 21. In the prior art mentioned above, the spacer receiving the load in the thrust direction is interposed, however, in the present invention, the load in the thrust direction is transmitted directly by the slide contact surface 26 between the rings. In other words, as the constituting parts interposed between the rings, there is only provided with a sealing means constituted by a pair of O-rings and face seals.

[0039] The third ring 11 is pressure inserted to the pin 14 in the same manner as the first ring 9. A slide portion 22 between both the rings has the same structure as that of the slide portion 21 mentioned above, and has only a sealing means 30 constituted by a pair of O-rings 16 and 16 and face seals 15 and 15, and a sealing surface 29 formed by the sealing means and a slide contact surface 27 between both the rings are positioned on the same flat plane.

[0040] Further, the first ring 9, the second ring 10 and the third ring 11 have respective diameters  $D_1$ ,  $D_2$  and  $D_3$ , and have a relation  $D_1 < D_2 < D_3$ . In accordance with the structure mentioned above, it is possible to easily fit to a member pivoting the pin assembly 20 and a pivotally supported member.

[0041] The pin assembly 20 having the structure mentioned above is especially exposed to a great load in both the radial and thrust directions, and is preferably used in the pivoting apparatus of the bogie having the track roller of the track-type drive system in which a lot of dusts exist in the environment where the system is used. FIG. 3 is a schematic view of a structure in the case of being applied to the pivoting apparatus of the bogie.

[0042] The bogie is constituted by a track roller (not shown in FIG. 3), a first bogie link 8 pivoted to the track frame 1, and a second bogie link 23 pivoted to the first bogie link 8 and corresponding to a pedestal of the track roller. The pin assembly 20 is used for pivoting the first bogie link 8 to the track frame 1 and pivoting the second bogie link 23 to the first bogie link 8. Details are as follows.

[0043] The track frame 1 is swingably attached to both side portions of a vehicle (not shown). A bracket 7 having an inverted U-shaped cross sectional shape is protruded from right and left sides of a lower portion of the track frame 1. An opening for the pin assembly 20 is provided in the bracket 7. One end of the first bogie link 8 is fitted and inserted to the bracket 7 from a lower side. The first bogie link 8 has an inverted L-shaped side elevational shape, and is structured such that one end is pivoted by the bracket 7 and another end is pivoted by the second bogie link 23. Accordingly, openings for the pin assembly 20 are provided in one end and another end.

[0044] The pin assembly 20 is integrally pressure inserted to the opening of the bracket 7 from an outer direction of the first bogie link 8. The first link 9 and the third link 11 correspond to the opening of the bracket 7, and the second cylinder 10 corresponds to the opening in one end of the first bogie link 8. Inner diameters of the respective openings are set such diameters as to be interference fitted to the outer diameters  $D_1$ ,  $D_2$  and  $D_3$  of the rings. As a result, the first

ring 9 and the third ring 11 are fitted to the bracket 7, and the second ring 10 is fitted to the first bogie link 8.

[0045] The second bogie link 23 pivotally supports the track roller in one end and another end, and has an opening for the pin assembly 20 in a center portion therebetween. In FIG. 3, there is illustrated only a plate in a side portion of the second bogie link. In the same manner as the pivotally supported portion mentioned above, the pin assembly 20 is pressure inserted to the opening in another end of the link from an outer side of the first bogie link 8. In accordance with the pressure insertion, the first link 9 and the third link 11 of the pin assembly 20 are firmly attached to the first bogie link 8, and the second link is firmly fitted to the second bogie link 23.

[0046] In accordance with the present invention, since the contact portions between the first ring and the second ring and between the second ring and the third ring are each constituted by substantially one flat plane in the radial direction of the pin assembly, the lubricant easily circulates around the contact portions and the obstacle in lubrication is hard to be generated. Further, since only the sealing means is interposed in the slide portion while abolishing the spacer, and the ring and the pin are structured as the integral pin assembly, it is possible to easily assemble the pin assembly itself and assemble the pivotally supported portion.

[0047] The description mentioned above is given only of the specific embodiments in accordance with the present invention, and the present invention is not limited to the embodiments. The other aspects of the present invention which those skilled in the art can carry out by studying the drawings, the specification and the claims are included in the technical scope of the present invention.

What is claimed is:

1. A pin assembly for a track roller bogie of a track-type drive system, comprising:

- a pin having a lubricant charging hole and a lubricant delivering hole delivering the lubricant from the lubricant charging hole to an outer peripheral portion in an inner portion thereof;
- a first ring having a contact surface with said pin in one end so as to be firmly attached to the pin and having an outer diameter  $D_1$ ;
- a second ring brought into contact with another end side of said first ring in an axial direction of the pin so as to be rotatably pivoted to the pin and having an outer diameter  $D_2$ ; and
- a third ring brought into contact with another end side of said second ring in an axial direction of the pin so as to be firmly attached to the pin and having an outer diameter  $D_3$ ,

wherein a part of a ring end surface contacted among said first, second and third rings has an annular recess portion, and said annular recess portion consists of a sealing means between rings for sealing therebetween, and said outer diameters  $D_1$ ,  $D_2$  and  $D_3$  have a relation  $D_1 < D_2 < D_3$ .

2. A track-type drive system comprising:

a track roller bogie having a track frame, an idler, a sprocket, a carrier roller and a track roller and pivoted to said track frame; and

a crawler belt wound around them,

wherein the track roller bogie is pivoted to the track frame by the pin assembly as claimed in claim 1.

3. A track-type drive system comprising:

a track roller bogie having a track frame, an idler, a sprocket, a carrier roller and a track roller and pivoted to said track frame; and

a crawler belt wound around them,

wherein said track roller bogie is constituted by a first bogie link pivoted to the track frame, and a second bogie link pivoted to said first bogie link and to which the track roller is mounted, and

wherein said second bogie link is pivoted to said first bogie link by the pin assembly as claimed in claim 1.

4. The pin assembly according to claim 1, wherein the slide portion among said first ring, said second ring and said third ring is constituted by a slide contact surface with which each of the rings is directly contacted, and a seal surface of said sealing means in correspondence to each of the slide

contact surfaces, and said slide contact surface and the seal surface form a substantially one flat plane in a radial direction.

5. A track-type drive system comprising:

a track roller bogie having a track frame, an idler, a sprocket, a carrier roller and a track roller and pivoted to said track frame; and

a crawler belt wound around them,

wherein the track roller bogie is pivoted to the track frame by the pin assembly as claimed in claim 4.

6. A track-type drive system comprising:

a track roller bogie having a track frame, an idler, a sprocket, a carrier roller and a track roller and pivoted to said track frame; and

a crawler belt wound around them,

wherein said track roller bogie is constituted by a first bogie link pivoted to the track frame, and a second bogie link pivoted to said first bogie link and to which the track roller is mounted, and

wherein said second bogie link is pivoted to said first bogie link by the pin assembly as claimed in claim 4.

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